NEW CONSIDERATIONS REGARDING THE CORONA IN THE VELLOZIACEAE[1]

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Abstract

Subfamily Barbacenioideae of the Velloziaceae is characterized by sessile anthers that are connected to a corona (or to the upper part of the hypanthium). *Barbacenia spiralis* L. B. Smith & Ayensu, however, displays a characteristic that distinguishes it clearly from the rest of the Barbacenioideae. It has stamens in which the filaments and anthers are totally independent of the corona lobes. This feature is considered important enough to justify the recognition of a new genus, based on this species.

Menezes (1970, 1973) concluded that the petaloid appendices found in the genus *Barbacenia* (Vandelli, 1788) and described as "flattened filaments" by the latter author and all later specialists of the family Velloziaceae, including Smith (1962), should in fact be regarded as lobes of a corona, as in *Narcissus* (Amaryllidaceae).

Studies of the floral vascular tube of many species belonging until then to *Barbacenia* showed the vascular bundles of the petaloid appendices to diverge from petal and sepal traces in the upper part of the hypanthium and to display an inversion (Menezes, 1970, 1973). A similar inversion of tissues was observed by Arber (1937) in the corona of the Amaryllidaceae, where the xylem of the corona bundles is turned toward the xylem of the petal (or sepal) bundles, and the phloem is internal to the xylem.

According to the available evidence, if the petaloid appendices were "flattened filaments," then their vasculature should consist of bundles originating from the staminal trace. But this is not the case: not only do the bundles of the corona originate in the perianth, but the staminal trace itself passes through the inside of the corona without any alteration in its concentric structure before penetrating the anther (Menezes, 1970, 1973, 1984).

Other authors have attempted to explain the nature of these petaloid appendices. On the basis of external morphology, Noher de Halac & Cocucci (1971) interpreted them as staminodes. Smith & Ayensu (1976), while admitting that either the staminode concept of Noher de Halac & Cocucci or the corona concept of Menezes might be correct, adopted the term "coronoid appendices" (Smith & Ayensu, 1976, 1980) in partial support of Menezes's hypothesis.

The present work considers the consequences on generic delimitation within subfamily Barbacenioideae Menezes of our new observations on *Barbacenia spiralis* Smith & Ayensu.

Materials and Methods

The following plant material was collected for analysis: *Barbacenia spiralis* L. B. Smith & Ayensu, Brazil. Mato Grosso: Muncipio de Diamantina, Curralinho, 13 Nov. 1980, *Menezes 1043* (SPF). *Pleurostima plantaginea* (L. B. Smith) Menezes, Brazil. Mato Grosso: Serra do Cipó at km 128, 14 July 1971, *Menezes 129* (SPF).

Anatomical studies were based on serial sections of material fixed in FAA 50 (Johansen, 1940) and embedded in paraffin. Sections were stained with safranin and fast green (Sass, 1951).

Results

As the basic pattern of vascularization in the Velloziaceae has previously been described in other species by Menezes (1973), only aspects relevant to *Barbacenia spiralis* are described here.

Figure 1 shows a flower of *Barbacenia spiralis*,

[1] Gratitude is due to Dr. Simon Mayo (Royal Botanic Gardens, Kew) and Dr. W. Wayt Thomas (New York Botanical Garden) for suggestions and help with English and to Maria Odeti F. Pedrosantti (UNICAMP) for assistance preparing slides. Financial support came from CNPq (Conselho Nacional do Desenvolvimento Científico e Tenológico—Proc. 300939-80), FAPESP (Fundação de Amparo à Pesquisa de São Paulo—Proc. 81/0088-2), and WWF (World Wildlife Fund—Project 3311).

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which is sectioned in Figure 2. The filament (Fl) is completely free from the corona (Co) lobe, and a descending basal region (Dbr) of the filament can be seen; the anther (An) is basifixed. The auriculate and sessile anther (An) is attached to the corona lobe in *Pleurostima plantaginea* (Fig. 3). The anther is easily detached (Fig. 4) and is accompanied by the filament tissues (Af), which are superficially adnate to the corona.

In *Barbacenia spiralis* (Figs. 5–16) the petal staminal traces (Ps) are situated opposite the petal–corona complex (Cpc), which divides into a branch that enters the petal (P) and to one that runs into the corona (Co). The ventral bundle of the carpel (V) and the stamen–carpel complex (Sc) originate from the same basic bundle, situated at the base of the ovary. The stamen–carpel complex also gives rise to the dorsal bundle of the carpel (D) and the stamen trace opposite the sepal (Ss).

In the peduncular region of the flower (Fig. 6) there are 12 fundamental bundles (Fb). Further up (Fig. 7), the locules still have no ovules, but septal nectaries (Sn) appear. At the level of Figure 8 the placentas bear ovules, and nectariferous sacs (Ns) can be observed. The ventral bundles of the carpel (V), the dorsal bundles (D), the traces of the sepalar (Ss) and petalar (Ps) stamens, and of the petal–corona (Cpc) and sepal–corona (Csc) complexes are now distinct. The septal nectaries follow the locules right from the base (Fig. 7), and even when the locules (Lo) close (Fig. 11), the nectariferous sacs remain wide open (Ns; Figs. 10, 11). In Figure 12 a descending basal region (Dbr) of the filament (less prominent than in Figs. 2 and 5) is seen. This brings the filament (Fl; Figs. 13, 14) close to the style (St). Figure 12 also shows the individualization of two corona lobes (Co). At the level of Figures 14 and 15, the petals, sepals, petalar and sepalar lobes of the corona, and the filaments of petalar and sepalar stamens are all clearly distinct. At a higher plane (Fig. 16) the corona lobes are no longer visible. The anthers are introrsely dehiscent, although three anthers appear to be extrorsely dehiscent due to twisting of the filaments.

Figures 17–20 show details of the vascularization displayed in Figures 5–16. In Figure 17 divergences (Dv) of the sepalar traces to form the corona traces (Ct) may be seen. Figures 18–20 show a single plane at different scales. The region indicated by two dotted lines in Figure 18 is shown in greater detail in Figure 19; Figure 20 shows a magnified portion of Figure 19. In Figure 20 the corona bundle (Cb) shows inversion of the vascular tissues: the xylem (X) is turned outward to face the xylem of the petal (P), while the phloem (Ph) is internal to the xylem.

Discussion

Barbacenia spiralis was first described based on a specimen with only a flower bud. For this study, the species was collected in full flower. If there were any remaining doubts as to the true nature of the petaloid appendices in subfamily Barbacenioideae, they can now be put to rest, since in this species, the filaments and corona lobes are completely separate. The origin and inversion of the bundles indicate that the corona is an appendage of the perianth; there is, furthermore, a complete independence of stamen and corona. This feature is unique to Barbacenioideae, which contain some 106 species in three genera. All except *B. spiralis* have sessile anthers (basifixed-auriculate or dorsifixed) adnate to the corona in *Barbacenia*, *Aylthonia*, and *Pleurostima* sect. *Graziela*, or to the hypanthium in sect. *Pleurostima* (Menezes, 1980b).

According to the circumscription of Barbacenioideae proposed by Menezes (1970, 1971), the sessile anther connected to the corona lobe is a fundamental character. Studies of leaf anatomy (Menezes, 1970, 1975) permitted the addition of a further fundamental character for Barbacenioideae: the presence of a double sheath in the vascular bundles of the leaf (Menezes, 1980a, b, 1984). In subfamily Vellozioideae, the bundle sheath is simple and each anther is connected to a filament, although this filament may at times be inconspicuous (Menezes, 1980a, b).

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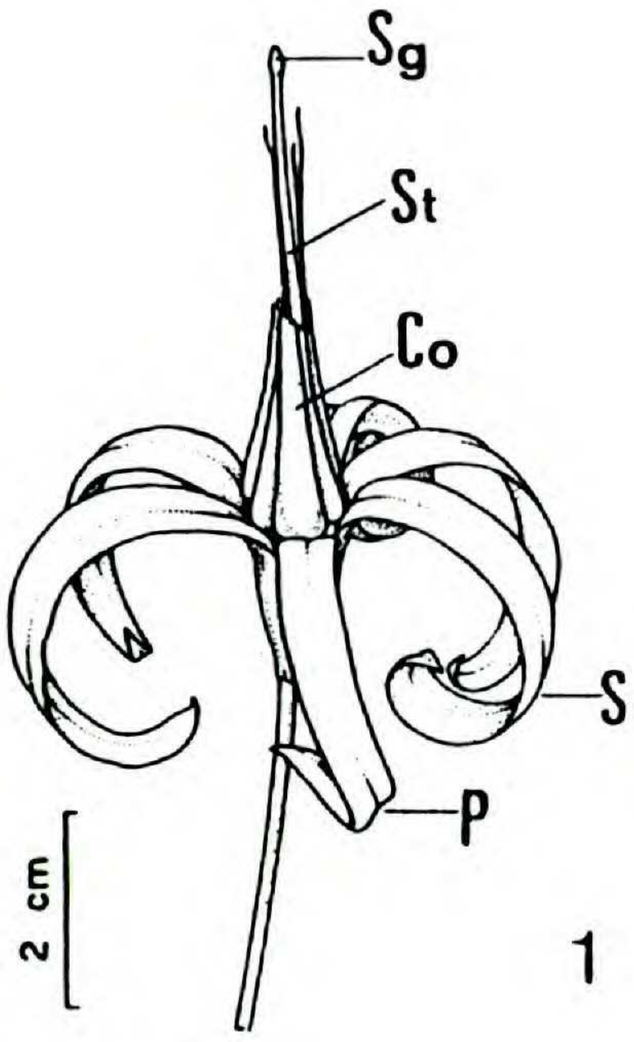
Figures 1–4. Flowers of *Barbacenia spiralis* and *Pleurostima plantaginea*. 1, 2. *B. spiralis*.—1. Flower with flexed petals (P) and sepals (S), and corona lobes simulating a tube.—2. Longitudinal section through flower revealing stamen with basifixed anther on a cylindric filament (Fl) that is independent of the corona and has a descending basal region (Dbr) below the terete portion. 3, 4. *Pleurostima plantaginea*.—3. Petal and corona lobe with the basifixed-auriculate and sessile anther (An).—4. Anther separated from the corona, showing the previously adnate filament (Af) free from the corona lobe. Au—auricle; Hy—hypanthium; Sg—stigma; St—style.



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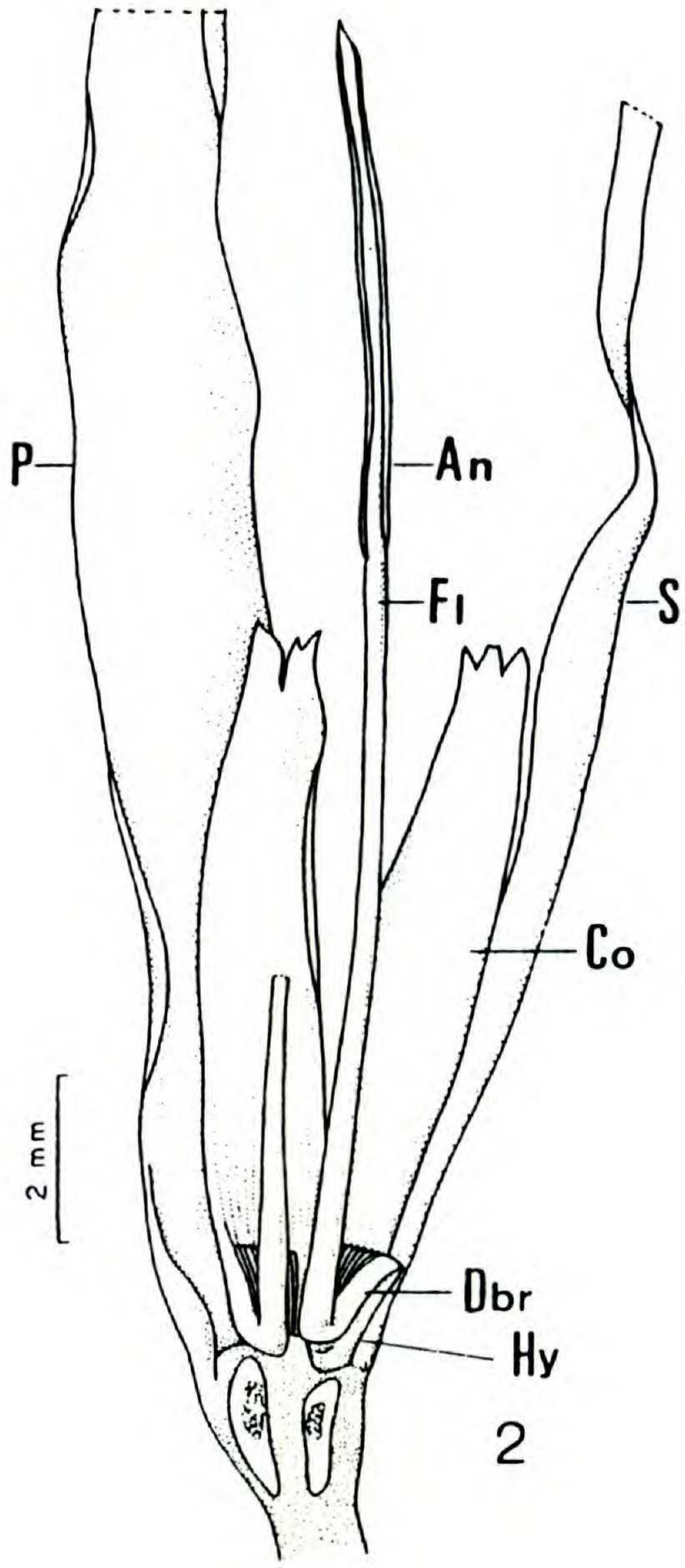

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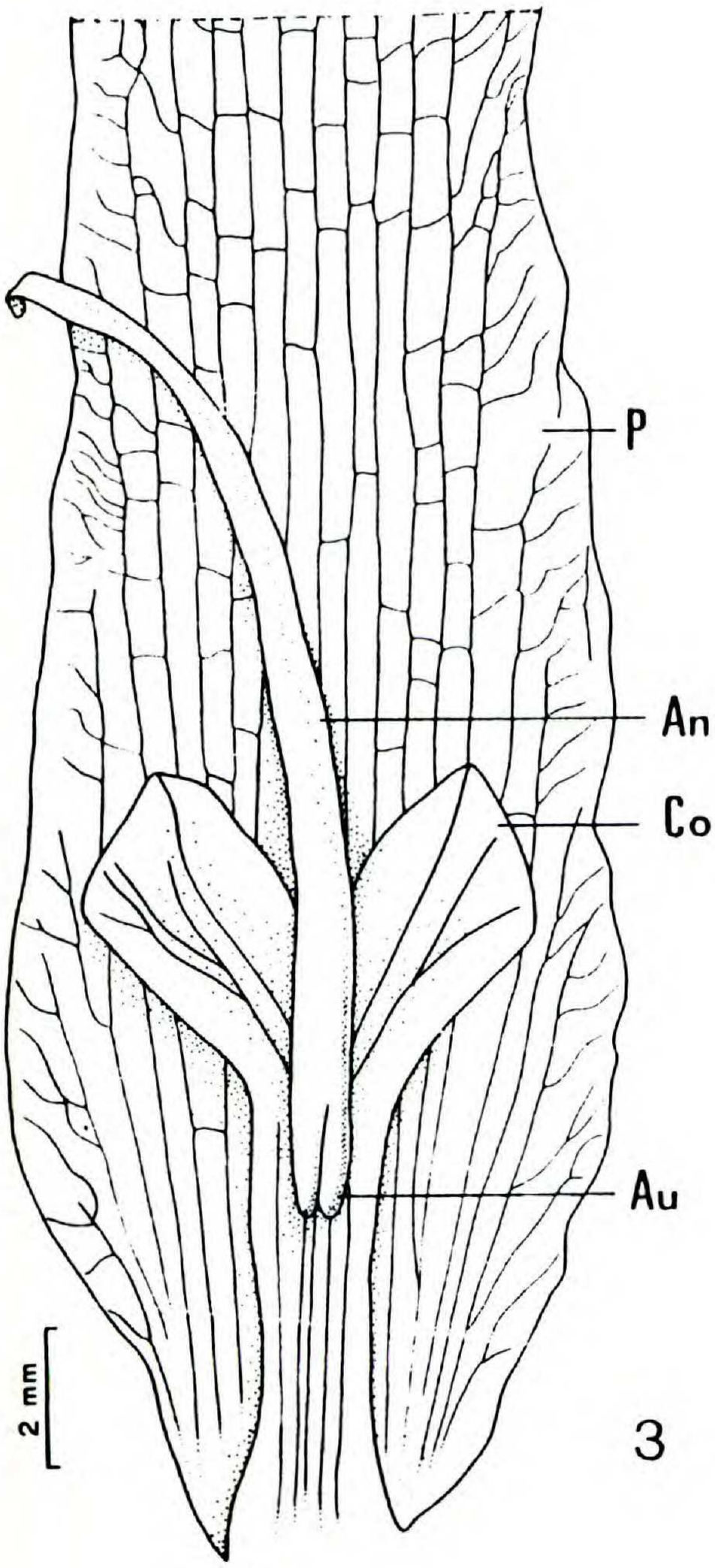

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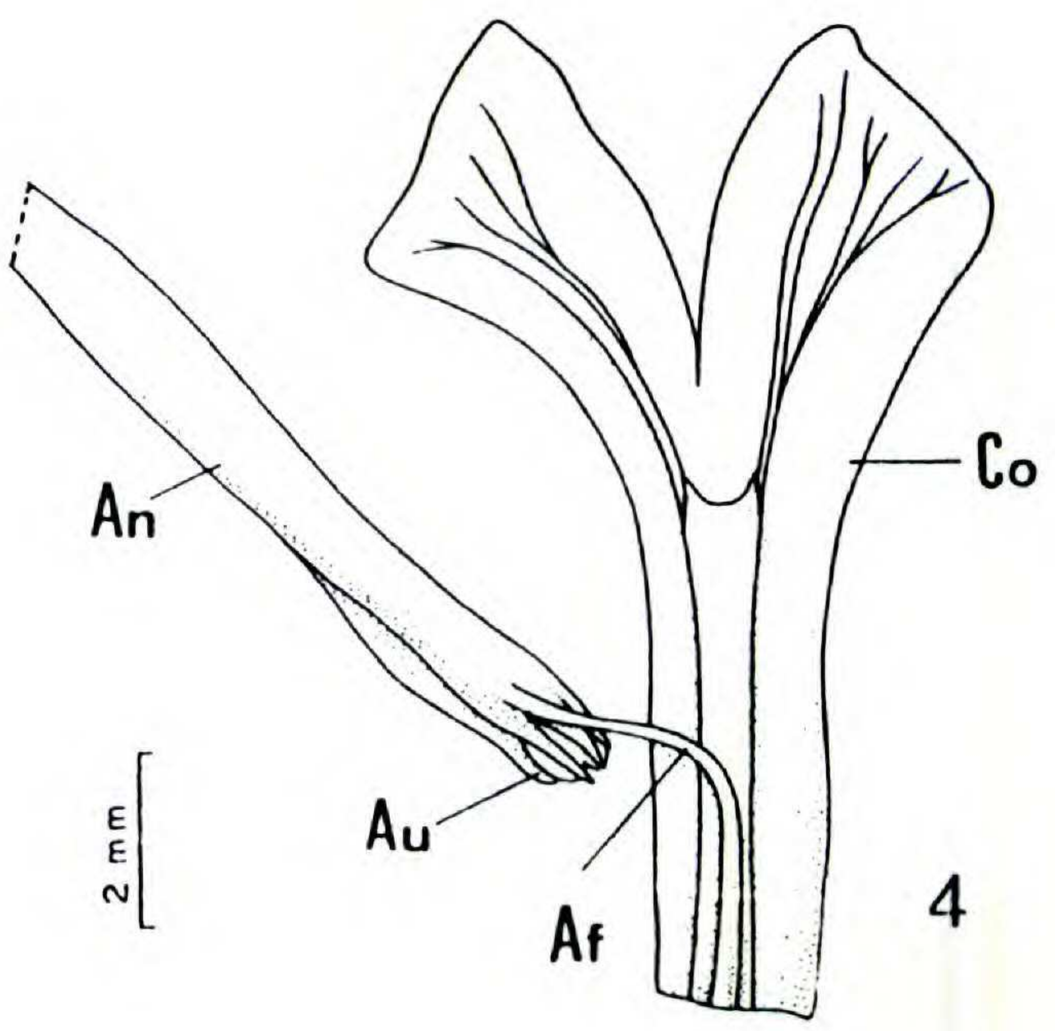

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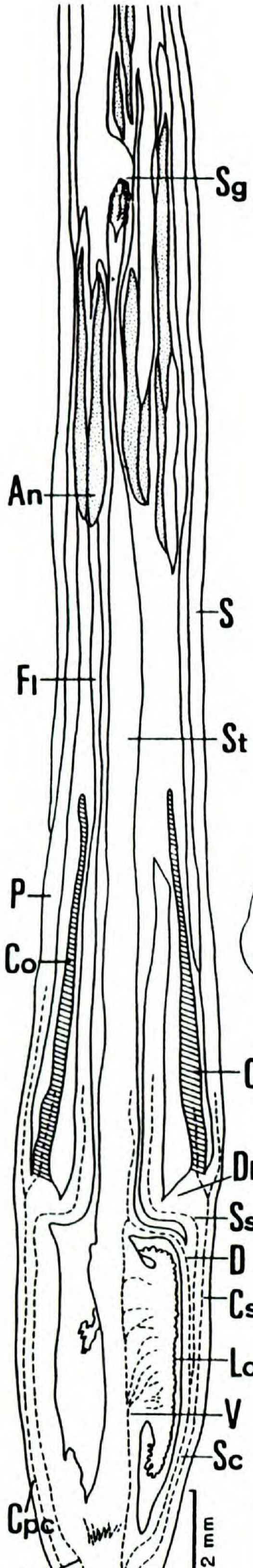
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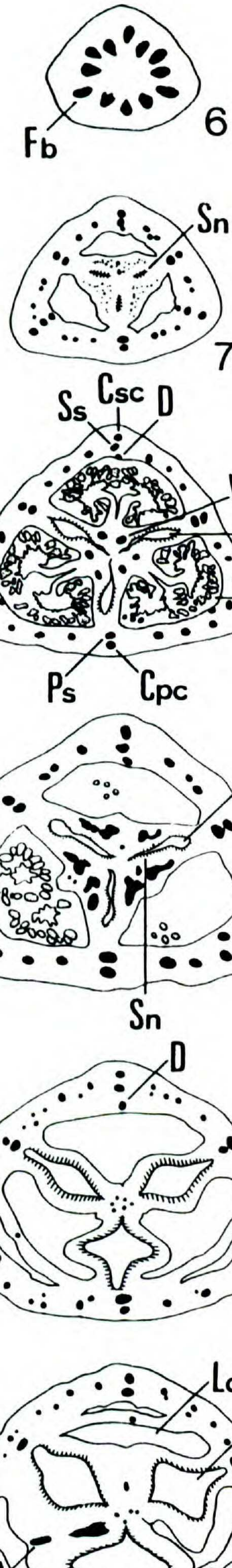
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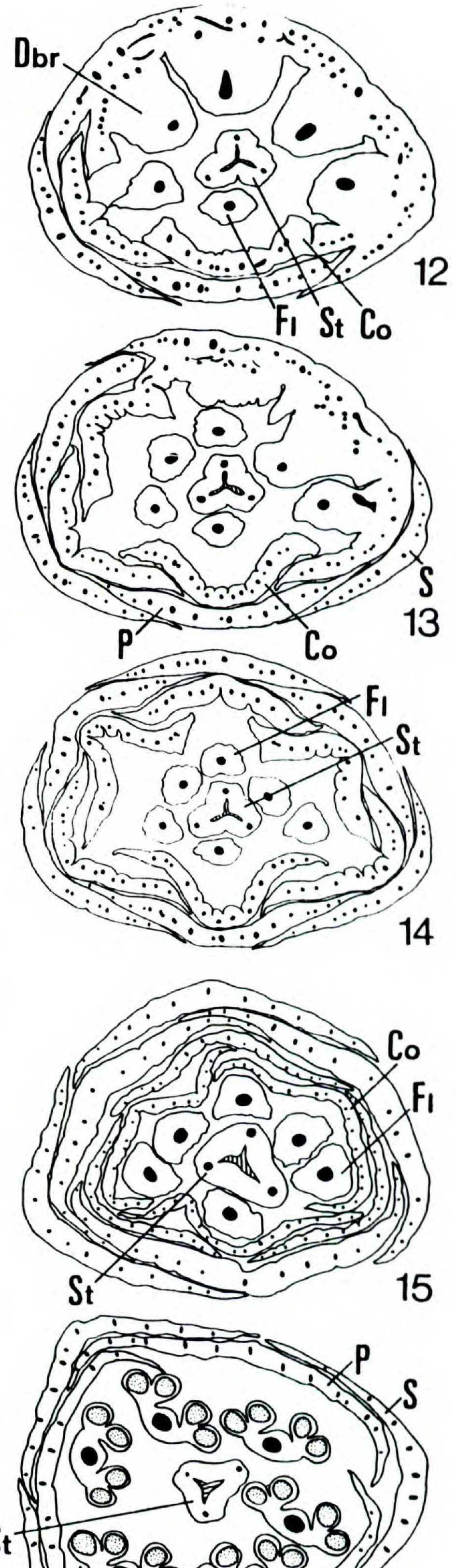
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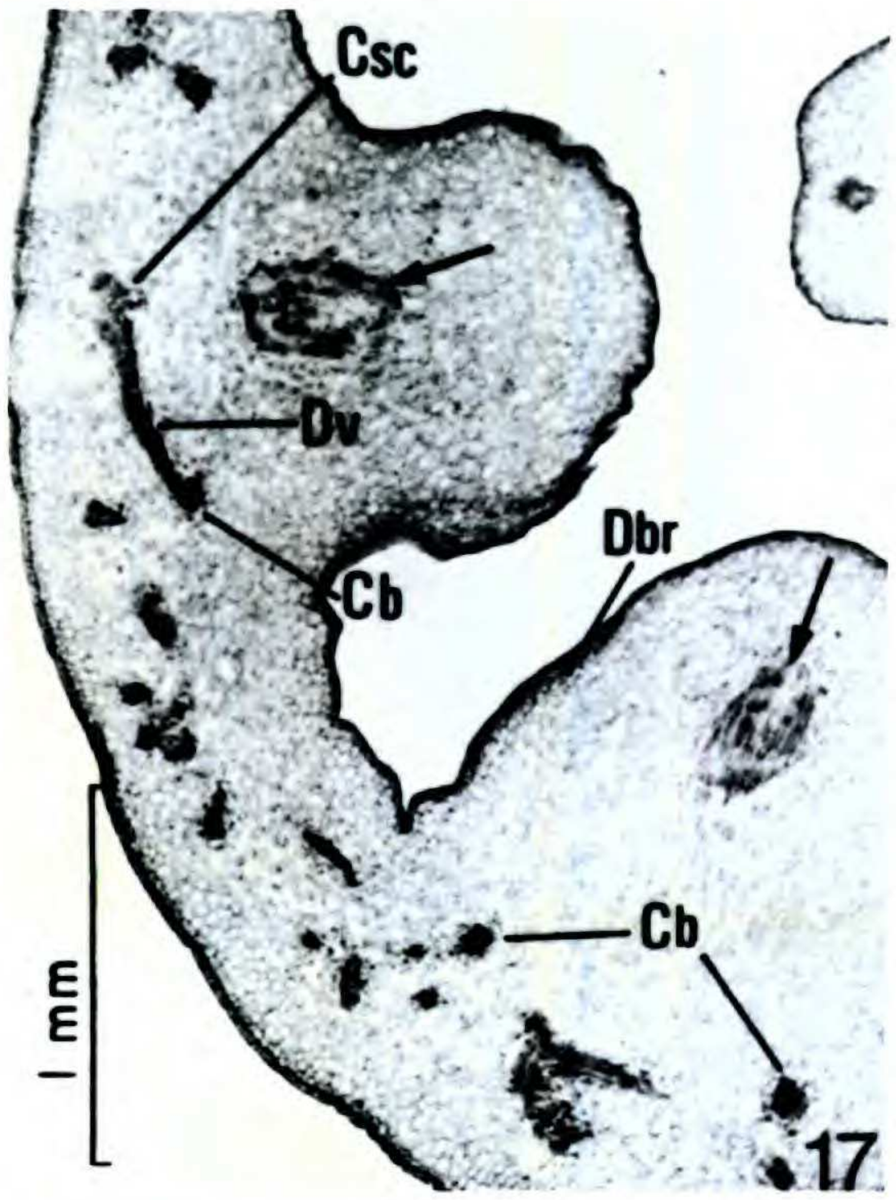

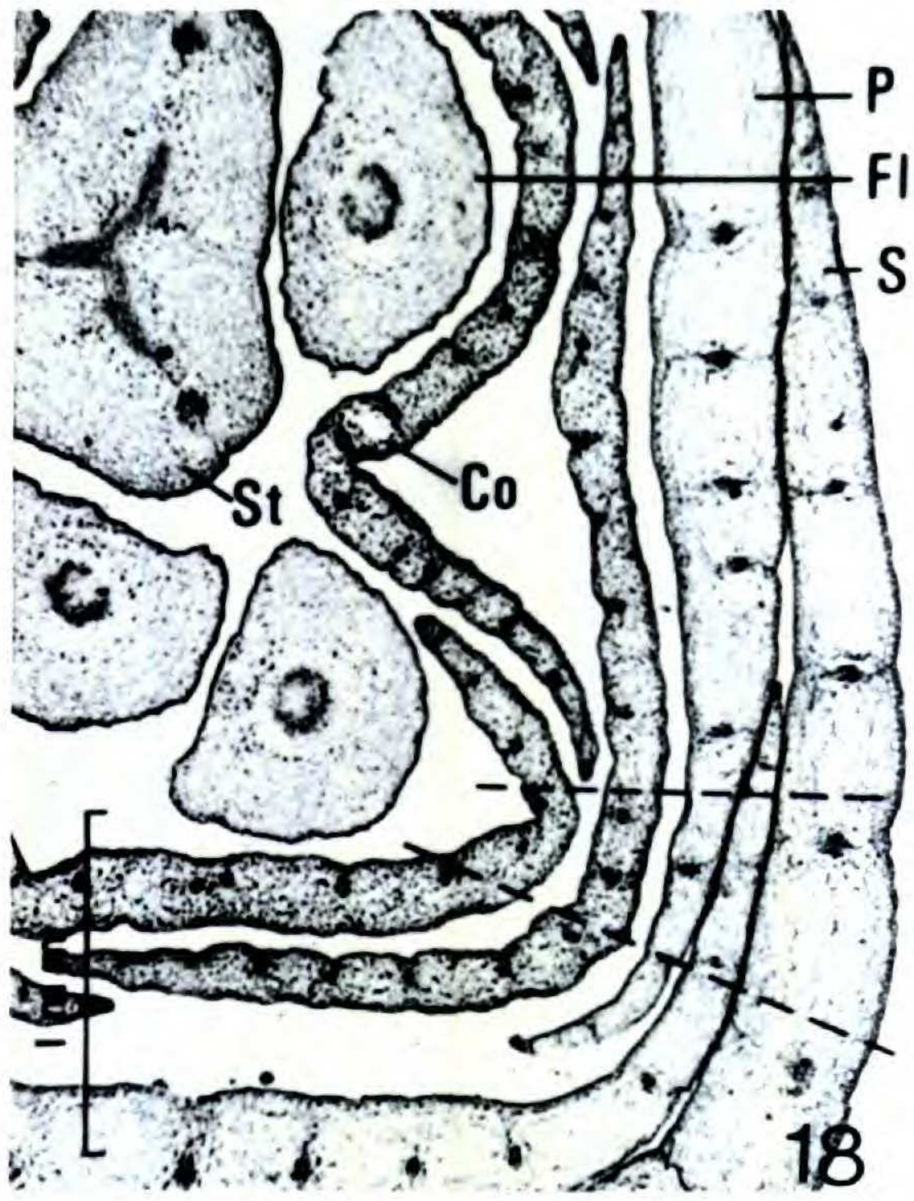

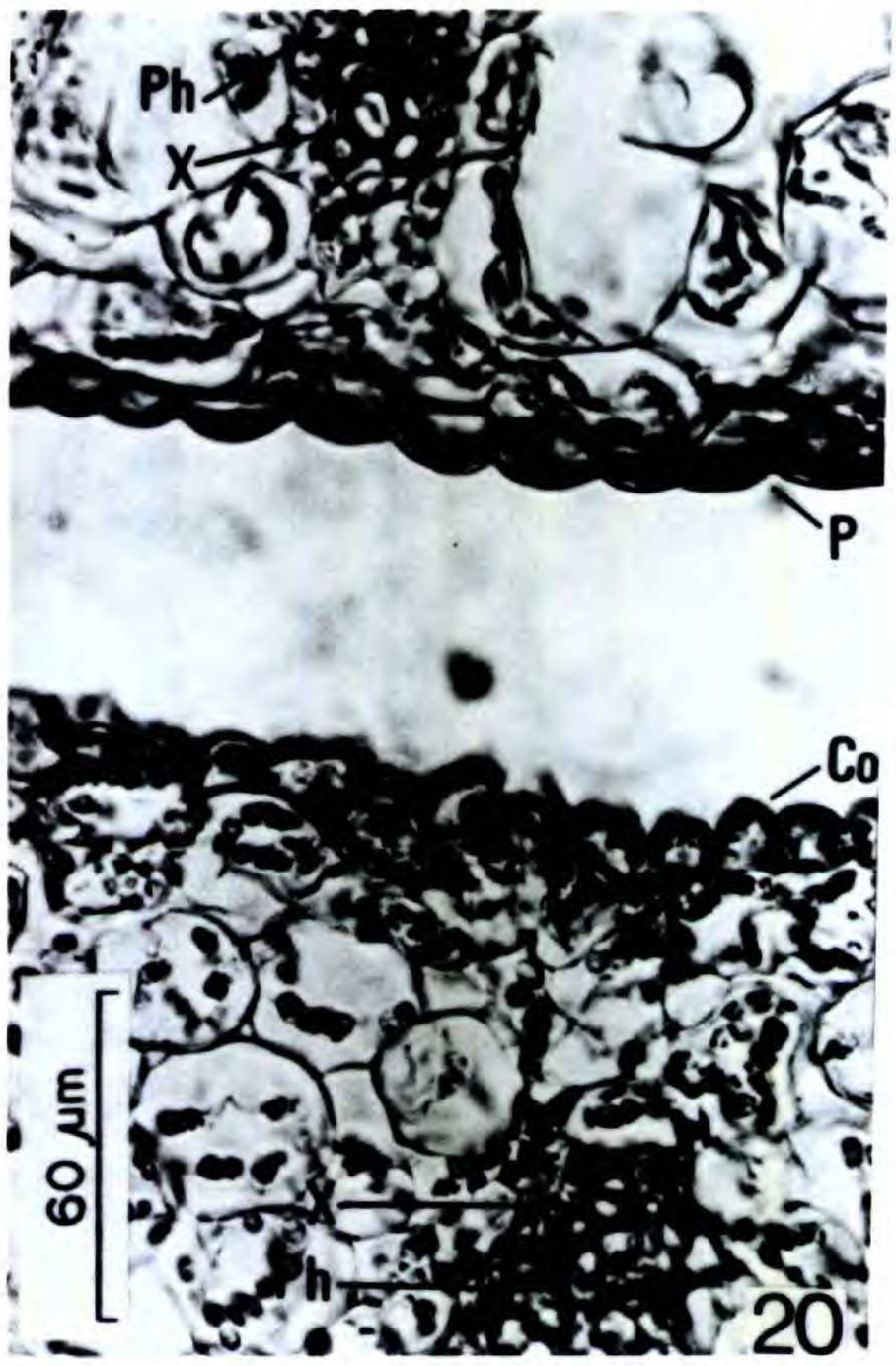

FIGURES 17–20. Details of the vascularization of *Barbacenia spiralis* flower bud.—17. Divergence of the corona trace (Dv) from the sepal–corona complex (Csc). The corona bundles (Cb) are not attached to the stamen bundles (arrows).—18. Cross section of flower bud with corona lobes (Co) independent of filaments (Fl).—19. Enlargement of the portion of Figure 18 between the dashed lines.—20. Enlargement of portion of Figure 19 between dashed lines; the xylem (X) is turned outward and the phloem (Ph) is internal to the xylem. Hy—hypanthium; P—petal; S—sepal; St—style.

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FIGURES 5–16. Floral vascularization of *Barbacenia spiralis*. See text for explanation of figures. An—anther; Co—corona; Cpc—petal–corona complex; Csc—sepal–corona complex; D—carpel dorsal bundle; Dbr—descending basal region; Fb—fundamental bundle; Fl—filament; Lo—locule; Ns—nectariferous sacs; P—petal; Ps—petalar stamen trace; S—sepal; Sc—stamen–carpel complex; Sg—stigma; Sn—septal nectary; Ss—sepalar stamen trace; St—style; V—carpel ventral bundle.

Barbacenia spiralis has a well developed filament and a basifixed anther (without auricle), as in *Vellozia* (Vellozioideae); the flower, however, has a corona, and the leaf bundle sheath is double (endodermic internally, and externally a sheath derived from a mesophyll) as in the Barbacenioideae.

Thus *B. spiralis*, although belonging to Barbacenioideae, shows some intermediacy. Probably, free filaments should be considered ancestral to adnation of the filament to the corona seen in all other species of Barbacenioideae.

Other intermediate conditions are known: in *Pleurostima plantaginea* the filament is not deeply fused to the corona lobe, which thus shows a similar but presumably independently derived condition.

The filament independent of the corona lobe and auricle-free basifixed anther with distinct dehiscence (Menezes, 1988) by themselves justify the description of a new genus based on this species, which will be the subject of a forthcoming paper (Menezes & Semir, in prep.).

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